

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-022721

(43)Date of publication of application : 23.01.1998

(51)Int.Cl.

H01Q 7/00

(21)Application number : 08-170144

(71)Applicant : MITSUBISHI ELECTRIC CORP

(22)Date of filing : 28.06.1996

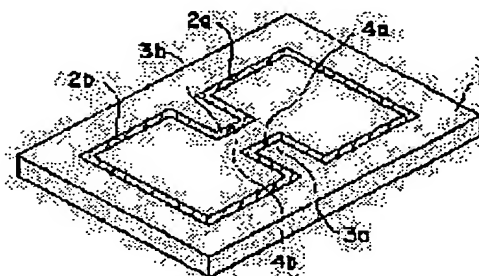
(72)Inventor : FUKUI TAKAHITO

## (54) PRINTED LOOP ANTENNA

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To accurately and easily prepare a loop antenna and to miniaturize a dimension shape by serially connecting a plurality of loop-like patterns of an optional shape through a power feeding means formed in the same layer on a printed board.

**SOLUTION:** On the printed board 1, the loop-like patterns 2a and 2b as the loop antenna are serially connected through power feeding lines 3a and 3b as the power feeding means formed in the same layer. Also, power feeding points 4a and 4b supply a current to the loop-like patterns 2a and 2b through the power feeding lines 3a and 3b. In this case, the loop-like patterns 2a and 2b are turned to two quadrilaterals, however, they can be the optional shape such as a circle or a triangle or the like. Also, the plural number of the loop-like patterns can be provided. Further, the kind of the printed board 1 can be a flexible printed board and connection between the printed board can be performed by a pin or the like. Thus, the loop antenna is accurately and easily prepared and the dimension shape is miniaturized.



## LEGAL STATUS

[Date of request for examination] 22.09.1999

[Date of sending the examiner's decision of rejection] 16.10.2001

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

\* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] The print loop antenna equipped with two or more conductive loop-formation-like patterns formed on the printed circuit board, and an electric supply means to connect this loop-formation-like pattern to a serial or juxtaposition, and to supply electric power to this loop-formation-like pattern.

[Claim 2] An electric supply means is a print loop antenna according to claim 1 characterized by being the feeder established in the same layer as a loop-formation-like pattern.

[Claim 3] An electric supply means is a print loop antenna according to claim 1 characterized by being the electric supply object which penetrates the printed circuit board in which the loop-formation-like pattern was formed, and supplies electric power from the tooth back of this printed circuit board.

[Claim 4] The print loop antenna equipped with one or more passive elements loaded into one or more conductive loop-formation-like patterns formed on the printed circuit board, and this loop-formation-like pattern, an active element, or its both sides.

[Claim 5] The feeder to the loop-formation-like pattern and this loop-formation-like pattern which were formed in the same layer of the 1st printed circuit board, The conducting bar formed on the 2nd printed circuit board which carries out a laminating to the tooth back of said 1st printed circuit board, The print loop antenna equipped with the electric supply object which penetrates said 2nd printed circuit board and connects the feeder on said 1st printed circuit board, and the feeder on said 3rd printed circuit board with the feeder formed on the 3rd printed circuit board which carries out a laminating to the tooth back of this 2nd printed circuit board.

[Claim 6] the loop-formation-like pattern formed on the 1st printed circuit board, the loop-formation-like pattern formed on the 2nd printed circuit board which carries out a laminating to the tooth back of this 1st printed circuit board, the feeder formed on the 3rd printed circuit board which carries out a laminating to the tooth back of this 2nd printed circuit board, and said 2nd printed circuit board — penetrating — said feeder — this — the print loop antenna equipped with the electric-supply object which supplies electric power only to the loop-formation-like pattern on the 2nd printed circuit board.

[Claim 7] The feeder to the loop-formation-like pattern formed on the 1st printed circuit board, and the loop-formation-like pattern and this loop-formation-like pattern which were formed in the tooth back of said 1st printed circuit board at the same layer of the 2nd printed circuit board which carries out a laminating, The conducting bar formed on the 3rd printed circuit board which carries out a laminating to the tooth back of said 2nd printed circuit board, The print loop antenna equipped with the electric supply object which penetrates said 3rd printed circuit board and connects the feeder on said 2nd printed circuit board, and the feeder on said 4th printed circuit board with the feeder formed on the 4th printed circuit board which carries out a laminating to the tooth back of this 3rd printed circuit board.

---

[Translation done.]

## \* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the antenna equipment for radio, and the loop antenna which used the printed circuit board especially.

[0002]

[Description of the Prior Art] Although this conventional kind of loop antenna is constituted by the metallic ornaments 8 set up on the printed circuit board 9 so that the conducting bar 7 and it which were bent in the shape of a loop formation may be supported as shown in drawing 9, it is very difficult to bend a conducting bar 7 correctly in the shape of a loop formation. Moreover, since it is necessary to support a conducting bar 7 by metallic ornaments 8, it is difficult for a dimension configuration to become large and to attain the miniaturization of antenna equipment.

[0003] 1st printed circuit board 1a which drawing 10 showed the loop antenna with which everything but the former was miniaturized, and formed loop-formation-like pattern 2a, 2nd printed circuit board 1b which forms loop-formation-like pattern 2b and carries out a laminating to the tooth back of 1st printed circuit board 1a, Form loop-formation-like pattern 2c and it consists of the 3rd printed circuit board 1c which carries out a laminating to the tooth back of 2nd printed circuit board 1b. The end side of pattern 2a is connected to a printed circuit board 9, and the other end side of this pattern 2a is connected to the end side of pattern 2b through through holes 5a and 5b. The other end of pattern 2b is connected to the end side of pattern 2c through through holes 5c and 5d, and the other end side of pattern 2c is connected to the ground pattern 10 through through hole 5e and 5f and 5g.

[0004] Although the above-mentioned configuration has connected to a serial the loop-formation-like patterns 2a-2c formed in different printed circuit boards 1a-1c through through holes 5a-5g, it is difficult to be satisfied with this configuration of the other antenna property, for example, desired directivity, and a band, even if it can obtain desired antenna gain.

[0005]

[Problem(s) to be Solved by the Invention] Since the conventional loop antenna was constituted as mentioned above, with the configuration of drawing 9, it was difficult to bend a conducting bar correctly in the shape of a loop formation, and in order to support the conducting bar by metallic ornaments, the technical problem that a dimension configuration becomes large occurred. Moreover, with the configuration of drawing 10 which forms a loop antenna in one of two or more of the printed circuit boards which carried out the laminating, the technical problem that it was difficult to fulfill properties other than antenna gain occurred.

[0006] It aims at obtaining the print loop antenna which was made in order that this invention might solve the above technical problems, can miniaturize a dimension configuration, and can fulfill a desired antenna property.

[0007]

[Means for Solving the Problem] The print loop antenna concerning invention according to claim 1 is equipped with an electric supply means to connect to a serial or juxtaposition two or more conductive loop-formation-like patterns formed on the printed circuit board, and to supply electric power to this loop-formation-like pattern.

[0008] The print loop antenna concerning invention according to claim 2 makes the feeder established in the same layer as a loop-formation-like pattern an electric supply means.

[0009] The print loop antenna concerning invention according to claim 3 makes the electric supply object which penetrates the printed circuit board in which the loop-formation-like pattern was formed, and supplies electric power from the tooth back of this printed circuit board an electric supply means.

[0010] The print loop antenna concerning invention according to claim 4 is equipped with one or more passive elements loaded into one or more conductive loop-formation-like patterns formed on the printed circuit board, a \*\*\*\* component, or its both sides.

[0011] The print loop antenna concerning invention according to claim 5 The feeder to the loop-formation-like pattern and this loop-formation-like pattern which were formed in the same layer of the 1st printed circuit board, The conducting bar formed on the 2nd printed circuit board which carries out a laminating to the tooth back of said 1st printed circuit board, Having the feeder formed on the 3rd printed circuit board which carries out a laminating to the tooth back of this 2nd printed circuit board, an electric supply object penetrates said 2nd printed circuit board, and connects the feeder on said 1st printed circuit board, and the feeder on said 3rd printed circuit board.

[0012] The print loop antenna concerning invention according to claim 6 The loop-formation-like pattern formed on the 1st printed circuit board, and the loop-formation-like pattern formed on the 2nd printed circuit board which carries out a laminating to the tooth back of this 1st printed circuit board, It has the feeder formed on the 3rd printed circuit board which carries out a laminating to the tooth back of this 2nd printed circuit board, and an electric supply object penetrates said 2nd printed circuit board, and supplies electric power only to the loop-formation-like pattern on said 2nd printed circuit board in said feeder.

[0013] The print loop antenna concerning invention according to claim 7 The feeder to the loop-formation-like pattern formed on the 1st printed circuit board, and the loop-formation-like pattern and this loop-formation-like pattern which were formed in the tooth back of said 1st printed circuit board at the same layer of the 2nd printed circuit board which carries out a laminating, The conducting bar formed on the 3rd printed circuit board which carries out a laminating to the tooth back of said 2nd printed circuit board, Having the feeder formed on the 4th printed circuit board which carries out a laminating to the tooth back of this 3rd printed circuit board, an electric supply object penetrates said 3rd printed circuit board, and connects the feeder on said 2nd printed circuit board, and the feeder on said 4th printed circuit board.

[0014]

[Embodiment of the Invention] Hereafter, one gestalt of implementation of this invention is explained.

[0015] Gestalt 1. drawing 1 of operation is the perspective view showing the print loop antenna by the gestalt 1 of implementation of this invention. Loop-formation-like pattern 2a as a loop antenna and 2b are formed on a printed circuit board 1. It is the configuration of connecting with a serial through the feeders 3a and 3b as an electric supply means which formed this loop-formation-like pattern 2a and 2b in the same layer, and supplying electric power to loop-formation-like pattern 2a and 2b in a current from the feeding points 4a and 4b.

[0016] Drawing 2 forms loop-formation-like pattern 2a as a loop antenna, and 2b on 1st printed circuit board 1a which should be carried out a laminating. Feeder 3a formed on 2nd printed circuit board 1b which carries out a laminating to the tooth back of 1st printed circuit board 1a is connected with through hole 5a and the feeders 3c and 3d formed on 1st printed circuit board 1a through 5b, 5c, and 5d. Feeder 3b similarly formed on 2nd printed circuit board 1b is connected with through hole 5e and the feeders 3e and 3f formed on 1st printed circuit board 1a through 5f, 5g, and 5h. It is the configuration of connecting loop-formation-like pattern 2a and 2b to juxtaposition through these feeders, and supplying electric power to loop-formation-like pattern 2a and 2b in a current from the feeding points 4a and 4b of 2nd printed circuit board 1b.

[0017] As mentioned above, while being able to create the loop antenna of an arbitration configuration correctly and easily by making it a configuration like drawing 1 and drawing 2 according to the gestalt 1 of operation, it is possible to miniaturize a dimension configuration.

[0018] In addition, although the gestalt 1 of the above-mentioned implementation explained loop-formation-like pattern 2a of two squares, and 2b, a loop-formation-like pattern may be the configuration of arbitration, such as a round shape and a triangle, and one or more these loop-formation-like patterns may be prepared. Moreover, a flexible printed circuit board etc. is sufficient as the class of printed circuit board 1 (1a, 1b), and it may be connected to connection between printed circuit boards by a pin etc. other than a through hole as an electric supply means.

[0019] Gestalt 2. drawing 3 of operation is the configuration of supplying electric power to loop-formation-like pattern 2a and 2b in a current from the feeders 3c and 3d as an electric supply means which connected to the serial through the feeders 3a and 3b which formed loop-formation-like pattern 2a and 2b as a loop antenna on the printed circuit board 1, and formed this loop-formation-like pattern 2a and 2b in the same layer, and was formed in the same layer.

[0020] Drawing 4 forms loop-formation-like pattern 2a as a loop antenna, and 2b on 1st printed circuit board 1a

which should be carried out a laminating. It connects with a serial through the feeders 3a and 3b which formed this loop-formation-like pattern 2a and 2b in the same layer. It is the configuration of connecting with the feeders 3c and 3d formed on 2nd printed circuit board 1b which carries out a laminating to through hole 5a at the tooth back of 1st printed circuit board 1a through 5b, 5c, and 5d, and supplying electric power to loop-formation-like pattern 2a and 2b in a current from these feeders 3c and 3d.

[0021] Drawing 5 forms loop-formation-like pattern 2a as a loop antenna, and 2b on 1st printed circuit board 1a which should be carried out a laminating. Consider that this pattern 2a and 2b are one loop formation, and through hole 5a and 5b, 5c, and 5d are minded for the feeders 3a and 3b formed on 2nd printed circuit board 1b which carries out a laminating to the tooth back of this 1st printed circuit board 1a. It is the configuration that connect with the feeders 3c and 3d formed on 1st printed circuit board 1a, regard it as one loop formation through these feeders, and two points supply electric power to loop-formation-like pattern 2a and 2b in a current.

[0022] As mentioned above, according to the gestalt 2 of operation, it is possible by making it a configuration like drawing 3 and drawing 4 for connection with the feeder circuit formed on the same printed circuit board or another printed circuit board to become easy, and to miniaturize a dimension configuration. Moreover, by supplying electric power to a loop-formation-like pattern from two or more feeding points like drawing 5, the current distribution on a loop-formation-like pattern can be controlled and it is possible to acquire a desired antenna property.

[0023] In addition, although the gestalt 2 of the above-mentioned implementation explained that two points supplied electric power to a loop-formation-like pattern, one-point electric supply or multipoint electric supply is sufficient as the electric supply to a loop-formation-like pattern.

[0024] Gestalt 3. drawing 6 of operation is the configuration of forming loop-formation-like pattern 2a as a loop antenna, and 2b on a printed circuit board 1, loading the chip form resistance 6 into this loop-formation-like pattern 2a and 2b, connecting loop-formation-like pattern 2a and 2b to a serial through the feeders 3a and 3b formed in the same layer, and supplying electric power to loop-formation-like pattern 2a and 2b in a current from the feeding points 4a and 4b.

[0025] As mentioned above, according to the gestalt 3 of operation, by loading the chip form resistance 6 into loop-formation-like pattern 2a and 2b, the current distribution on loop-formation-like pattern 2a and 2b can be controlled, and it is possible to acquire a desired antenna property.

[0026] In addition, although the gestalt 3 of the above-mentioned operation explained the chip form resistance 6, the thing of the engine performance equivalent to the passive element created by passive elements, striplines, etc., such as a chip form capacitor, may be loaded, and active elements, such as a transistor, may be loaded.

[0027] Gestalt 4. drawing 7 of operation forms loop-formation-like pattern 2a as a loop antenna, and 2b on 1st printed circuit board 1a. It connects with a serial through the feeders 3a and 3b which formed this loop-formation-like pattern 2a and 2b in the same layer. 2nd printed circuit board 1b which left the conducting bar 7 is inserted between 1st printed circuit board 1a and 3rd printed circuit board 1c. It is the configuration of connecting with the feeders 3c and 3d which formed the feeders 3a and 3b on 1st printed circuit board 1a on 3rd printed circuit board 1c through through holes 5a and 5b, 5c, 5d, and 5e and 5f, and supplying electric power to loop-formation-like pattern 2a and 2b in a current from these feeders 3c and 3d.

[0028] Drawing 8 forms loop-formation-like pattern 2a as a loop antenna on 1st printed circuit board 1a. Through hole 5a and 5b, 5c, and 5d are minded for loop-formation-like pattern 2b as a loop antenna formed on 2nd printed circuit board 1b which carries out a laminating to the tooth back of 1st printed circuit board 1a. It is the configuration of connecting with the feeders 3a and 3b formed on 3rd printed circuit board 1c which carries out a laminating to the tooth back of 2nd printed circuit board 1b, and supplying electric power only to loop-formation-like pattern 2b in a current from these feeders 3a and 3b.

[0029] As mentioned above, according to the gestalt 4 of operation, by preparing 2nd printed circuit board 1b which left the conducting bar 7 in the tooth back of 1st printed circuit board 1a which formed the loop-formation-like pattern like drawing 7, this 2nd printed circuit board 1b can be used as a reflecting plate, and it is possible to acquire a desired antenna property. Moreover, by preparing loop-formation-like pattern 2a which does not supply electric power on loop-formation-like pattern 2b which supplied electric power like drawing 8, it can use as the wave director and a desired antenna property can be acquired.

[0030] In addition, although drawing 7 and drawing 8 were separately explained to be treatment with the gestalt 4 of the above-mentioned implementation, you may make it the configuration which sandwiched printed circuit board 1b which left the conducting bar 7, and loop-formation-like pattern 2b which supplied electric power

between loop-formation-like pattern 2a which does not supply electric power.

[0031]

[Effect of the Invention] As mentioned above, since according to invention according to claim 1 it constituted so that two or more conductive loop-formation-like patterns formed on the printed circuit board might be connected to a serial or juxtaposition, while being able to form the loop antenna of an arbitration configuration correctly and easily, it is effective in the ability to miniaturize a dimension.

[0032] Since according to invention according to claim 2 it constituted so that electric power might be supplied from the feeder established in the loop-formation-like pattern at the same layer, there is effectiveness which can be constituted in a super-thin shape.

[0033] Since according to invention according to claim 3 it constituted so that electric power might be supplied from the tooth back of this printed circuit board through the electric supply object which penetrated the printed circuit board in which the loop-formation-like pattern was formed, it is effective in the ability to supply electric power easily.

[0034] Since one or more passive elements, an active element, or its both sides was loaded and constituted in one or more conductive loop-formation-like patterns formed on the printed circuit board according to invention according to claim 4, it is effective in the ability to acquire a desired antenna property easily.

[0035] Since according to invention according to claim 5 the conducting bar was formed in the tooth back of the printed circuit board in which the feeder to a loop-formation-like pattern and this loop-formation-like pattern was formed and the printed circuit board was arranged and constituted, this conducting bar can be used as a reflecting plate, and it is effective in the ability to acquire a desired antenna property.

[0036] Since the printed circuit board in which the loop-formation-like pattern which does not supply electric power to the front face of the printed circuit board in which the loop-formation-like pattern was formed was formed was arranged and constituted according to invention according to claim 6, this loop-formation-like pattern that does not supply electric power can be used as the wave director, and it is effective in the ability to acquire a desired antenna property.

[0037] since the printed circuit board in which the loop-formation-like pattern which, on the other hand, looks like [ the whole surface of the printed circuit board in which the loop-formation-like pattern was formed ] the printed circuit board in which the conducting bar was formed, and does not supply electric power to it was formed was arranged and constituted according to invention according to claim 7, the loop-formation-like pattern which does not supply electric power can be used as the wave director by using a conducting bar as a reflecting plate, and it is effective in the ability to be able to acquire a desired antenna property easily.

---

[Translation done.]

## \* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

DESCRIPTION OF DRAWINGS

---

## [Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing the print loop antenna by the gestalt 1 of implementation of this invention.

[Drawing 2] It is the perspective view showing other examples of the print loop antenna by the gestalt 1 of implementation of this invention.

[Drawing 3] It is the perspective view showing the print loop antenna by the gestalt 2 of implementation of this invention.

[Drawing 4] It is the perspective view showing other examples of the print loop antenna by the gestalt 2 of implementation of this invention.

[Drawing 5] It is the perspective view showing other examples of the print loop antenna by the gestalt 2 of implementation of this invention.

[Drawing 6] It is the perspective view showing the print loop antenna by the gestalt 3 of implementation of this invention.

[Drawing 7] It is the perspective view showing the print loop antenna by the gestalt 4 of implementation of this invention.

[Drawing 8] It is the perspective view showing other examples of the print loop antenna by the gestalt 4 of implementation of this invention.

[Drawing 9] It is the perspective view showing the conventional loop antenna.

[Drawing 10] It is the perspective view showing the conventional print loop antenna.

## [Description of Notations]

1, 1a-1c A printed circuit board, 2a, 2b A loop-formation-like pattern, 3a - 3e feeder (electric supply means), 4a, 4b The feeding point (an electric supply means, electric supply object), 5a-5h through hole (an electric supply means, electric supply object), 6 Chip form resistance (passive element), 7 Conducting bar.

---

[Translation done.]

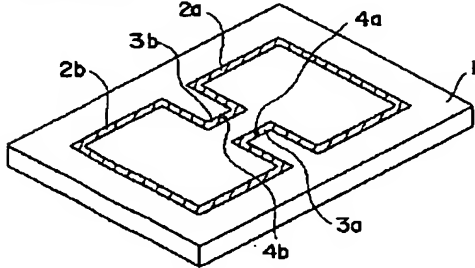
## \* NOTICES \*

JP0 and NCIP1 are not responsible for any damages caused by the use of this translation.

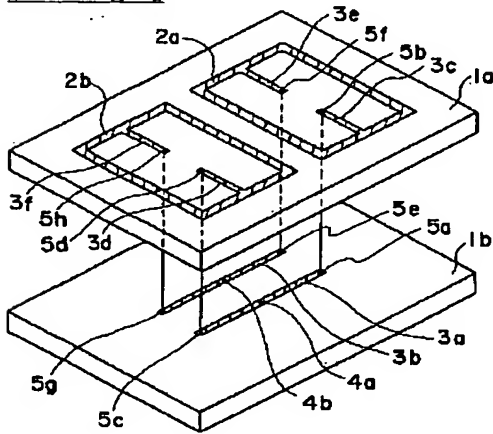
- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

## DRAWINGS

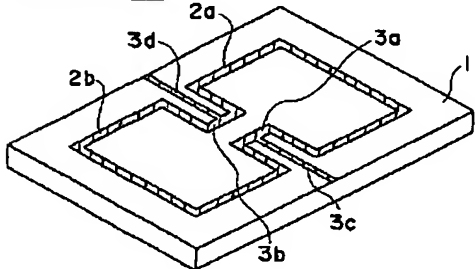
[Drawing 1]



[Drawing 2]



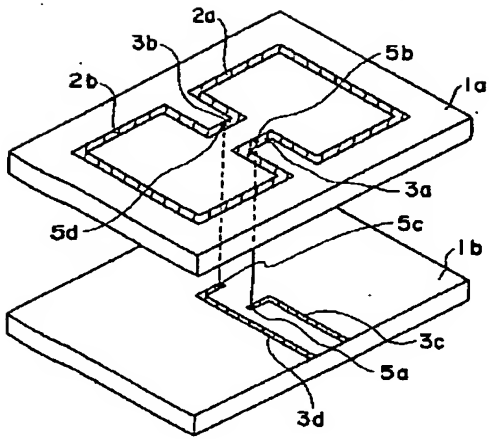
[Drawing 3]



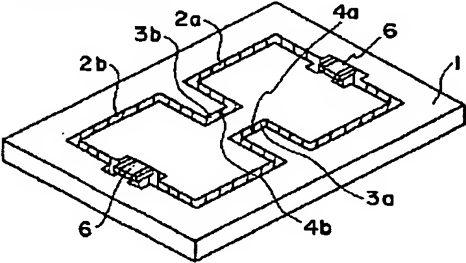
[Drawing 4]



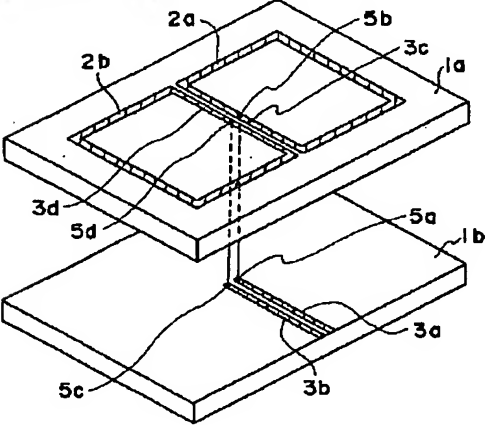




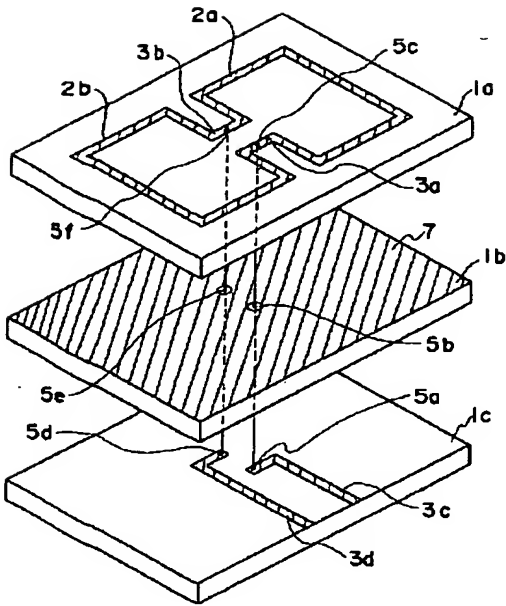
[Drawing 6]



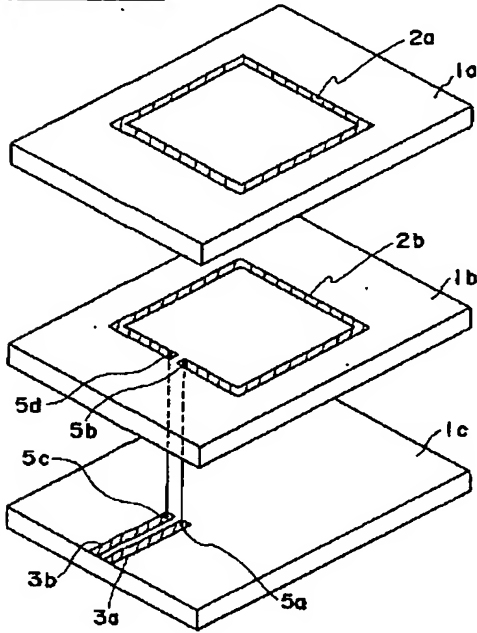
[Drawing 5]



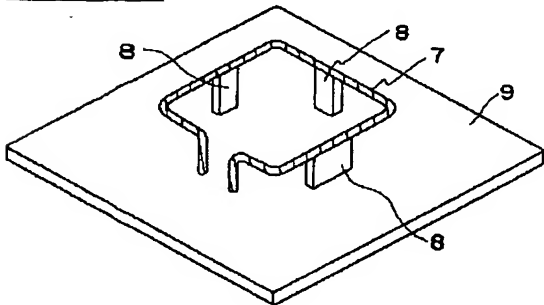
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Drawing 10]

